

A revision of the Australian species of *Hybanthus* Jacquin (Violaceae)

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Abstract

A taxonomic treatment is presented of the Australian species of *Hybanthus*. The history of the genus and the morphology and anatomy are discussed. The Australian species all belong to the subgenus *Ionidium* Schulze, two being in the Section *Suffruticosi* Schulze and the other nine in the new Section *Variabiles* proposed here. The following new taxa and new combinations are proposed: *H. eneuspermus* (L.) F. Muell. subsp. *stellarioides* (Domin) stat. nov., *H. floribundus* (Lindl.) F. Muell. subsp. *adpressus* subsp. nov., *H. floribundus* subsp. *curvifolius* subsp. nov., *H. volubilis* sp. nov. and *H. vernonii* (F. Muell.) F. Muell. subsp. *scaber* subsp. nov.

Chromosome counts are given for 8 of the 11 Australian species and the cytology is discussed. Distribution maps for all taxa are given.

Introduction

The name *Hybanthus* was published by Jacquin in 1760. It was based on the single species *H. havanensis*, which is therefore the type. St. Hilaire (1824, n.v.), united *Hybanthus* with *Ionidium* Vent. (1803), as the latter name was in current use and a renaming under *Hybanthus* would have caused too much confusion. In 1876 Mueller transferred the then accepted Australian *Ionidium* species to *Hybanthus*.

At the Vienna Congress in 1905 the name *Hybanthus* Jacq. (1760) was conserved against its earlier synonym *Calceolaria* Loefl. (1758). This conservation was later considered to be unnecessary as it was thought that the latter name was invalid being unaccompanied by a description, but Dandy (1969) pointed out that a generic description was provided. Therefore *Calceolaria* Loefl. must remain on the list of nomina rejicienda.

According to Airy Shaw (1966) there are 150 species of *Hybanthus* in North America, South America, Australia, Malaysia, South Africa and Asia. Eleven species occur in the mainland states of Australia, none being recorded in Tasmania.

Morphology of the Australian species

Habit

All the Australian species of *Hybanthus* develop secondary thickening, most being shrubs ranging from a height of 50 cm in the bushlets of *H. epacroides* to 2 m in the inland form of *H. floribundus*. One species, *H. epacroides*, develops spinescent branches. The American species *H. havanensis* also develops these spines, a feature comparatively rare in the Violaceae.

Hybanthus calycinus, *H. debilissimus*, *H. volubilis* and *H. monopetalus* are perennial herbs developing aerial growth from an underground rhizome. With age the rhizome and base of the stems develop a white pithy bark. This bark also develops on the stems of *H. aurantiacus* where it becomes noticeably fissured with age.

Leaves

The leaves of most species are alternate, but *H. monopetalus* has opposite leaves at the upper nodes in addition to the alternate leaves of the lower nodes. *H. bilobus* and *H. epacroides* have leaves clustered at the nodes.

Typically the margins are entire, exceptions being the denticulate margins in *H. aurantiacus* and crenate margins in some plants of *H. enneaspermus* subsp. *stellarioides*. The teeth and leaf apices are all tipped with a deciduous ovoid gland.

A pair of stipules is generally found at the base of each leaf. These may persist but are usually deciduous. One species, *H. debilissimus*, has no stipules.

Inflorescence

This is one of the most variable structures within the Australian species of *Hybanthus*. Some species have solitary flowers, others have cymes or racemes.

Schulze (1936) believed that the single axillary flowers of *Hybanthus* species arose through the gradual reduction of an axillary cymose inflorescence. This is the view commonly accepted and is illustrated by Lawrence (1951) and Rickett (1944, 1955).

In the Australian species the inflorescence types range from single flowers in the axils of leaves through cymes to racemes. Generally the inflorescence is axillary but occasionally it may be terminal. *H. cynulosus* has present on the same plant dichasial inflorescences as well as various modifications but the flowers are never solitary. *H. floribundus* shows variation from a dichasium to a solitary flower. In several plants the first division is dichasial, but in many of the subsequent bracts only one of the pair will develop a flower, the other bract containing an undeveloped bud. If further growth is monochasial (racemose) a short cincinnus is produced.

Peduncle and Pedicel

The peduncle of a solitary flower is in this paper considered to be the length of the flowering stalk occurring below the pair of bracts, and the pedicel is the portion above the bracts. These vary in relation to each other in length and pubescence.

The modified leaves on the flowering stalk are therefore correctly called bracts as they terminate the peduncle. They occur in pairs but one of the pair is situated slightly higher than the other. The flower buds are in the axils of the bracts.

Anterior Petal

This petal in the Australian species is distinctly spurred and is much larger than the lateral petals.

The lamina is typically suborbicular varying from ovate to reniform, and is generally blue-violet, except in *H. aurantiacus* and *H. enneaspermus* subsp. *stellarioides* which have yellow flowers. Veining of a darker colouration is present in the blue-violet flowering species.

The petal is distinctly clawed and the claw may be equal to or less than the length of the lateral petals. Generally the claw is white with pale blue or yellow areas. Two parallel raised ridges extend the length of the claw and into the proximal part of the lamina.

Between the ridges are varying amounts of white pubescence which may extend into the spur. The presence of the ridges and pubescence probably helps to prevent the loss of the secretion from the nectaries which are at the base of the anterior anthers.

Lateral Petals

There are two pairs of differently shaped petals of approximately equal length. The two outer petals are usually 1-nerved and narrower than the two inner petals which may be 3-nerved as in *H. vernonii* or 5-nerved as in *H. calycinus*.

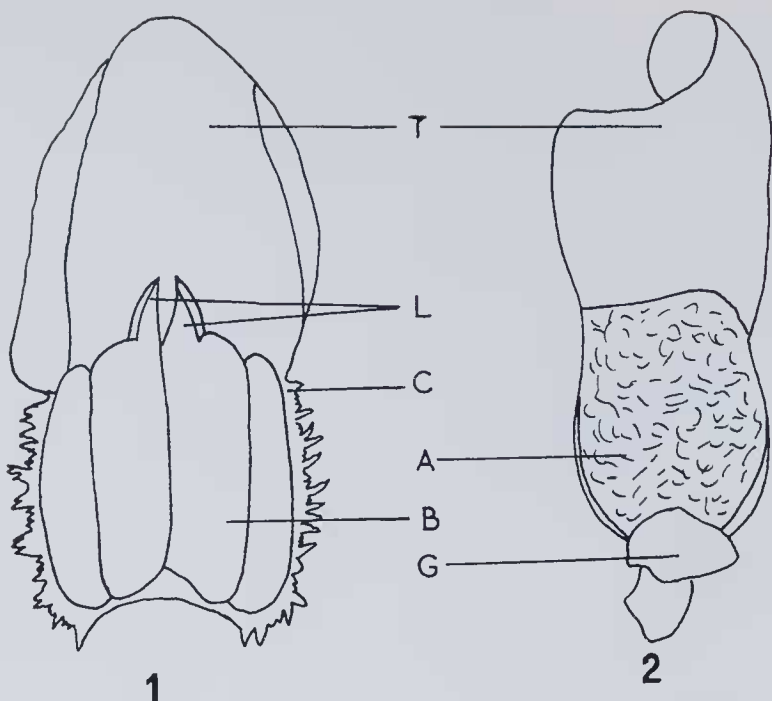


Figure 1—Anther structure (diagrammatic). 1—Under surface of posterior anther. 2—Upper surface of anterior anther. T = terminal connective appendage; L = loculi appendages; C = connecting tissue; B = bilocular anther; A = anther surface which may be glabrous or have varying degrees of pubescence; G = basal gland.

The petals of the outer pair are typically narrow-oblong and entire. The petals of the inner pair show numerous variations in shape between the species, but typically they are up to 0.5 mm longer than the outer petals.

Androecium

All five stamens are free with the edges of the anthers apparently united by connecting tissue. All have conspicuous terminal connective appendages (Figure 1) which are imbricate making the anthers appear to be connate into a tube. In all species the stamens are shorter than or equal to the lateral petals.

In all species the anterior pair of stamens bear at the base spur appendages which are nectaries. These nectaries may be sessile and glabrous as in *H. monopetalus*, glabrous and stalked as in some forms of *H. enneaspermus*, stalked with a tuft of hairs at the tip as in other forms of *H. enneaspermus*, or densely pubescent as in *H. aurantiacus*.

Apical loculi appendages (Figure 1) are found in some species or in some forms within a species. These appendages are narrow-triangular and always less than 0.5 mm long.

Gynoecium

The ovary, composed of three carpels, is regular and unilocular. It is distinctly 3-angled and in young fruit appears to be 3-keeled. In all species the ovary is ovoid-globose and glabrous. The style is two to three times as long as the ovary, beak shaped, and orientated towards the front of the flower.

Capsule

The capsule is thick-walled, coriaceous and distinctly 3-sided. It dehisces by splitting elastically from the apex into the three carpel constituents, the seeds being shot out. Some capsules of *H. calycinus* when left in the laboratory catapulted seeds up to a distance of one metre.

Seeds

The seeds of most species are ovoid-ellipsoidal and dark brown, ranging in size from 1.5 mm in *H. debilissimus* to 5 mm in *H. calycinus*. However, the seeds of *H. enneaspermus* and *H. aurantiacus* are elongate-ellipsoidal and yellowish in colour.

When soaked in water the seeds of *H. enneaspermus* and *H. aurantiacus* exude a mucilaginous substance. This was not seen when seeds of the other species were immersed in water.

The seeds of all species develop a thick, white, fleshy arillus, which, according to Raju (1958), originates as a small lump on the raphe as a result of divisions in the epidermal and hypodermal layers.

Following the definitions given by Martin (1946) the embryos of *H. enneaspermus* and *H. aurantiacus* are regarded as being spatulate whereas the embryos of the other species are linear. Martin found that in *Viola eriocarpa* and *Hybanthus concolor* the embryos were also spatulate. In *H. enneaspermus* and *H. aurantiacus* the embryo represents approximately half unit volumetric proportion of embryo to endosperm, whereas in the other species the embryo represents approximately one quarter unit.

Chromosome numbers (Table 1)

Chromosome counts have been made of 8 of the 10 Australian *Hybanthus* species including 7 of the 10 subspecies recognised. Most counts were obtained from pollen-mother cells which were fixed in acetic alcohol, stored in absolute alcohol and stained in acetic orcein. A few counts were obtained from root and shoot tip material, this previously having been treated with 0.1 per cent colchicine and macerated in HCl-alcohol before staining in acetic orcein.

The chromosomes at metaphase I in *Hybanthus monopetalus* are much larger than in any other species, but no mitotic material was available. Generally the mitotic material examined was unsatisfactory for karyotype analysis, for the chromosomes are so small that differences in appearance or size cannot be detected.

The chromosome numbers found are $n = 4, 6, 8, 12, 24$. The base numbers of $x = 4$ and $x = 6$ must be accepted for the genus. Four species have the base number $x = 4$. Two of these, *H. enneaspermus* and *H. aurantiacus*, are included in the section *Suffruticosi* and the other two, *H. monopetalus* and *H. volubilis*, are in the section *Variabiles*, this separation being based on morphological and anatomical features.

Hybanthus floribundus has a wide range of haploid numbers ($n = 6, 12, 24$). The plants with $n = 24$ occur as a small population in which only about 6 plants were found. They cannot be distinguished morphologically from $n = 12$ plants collected from other localities. Development and settlement in the area has probably affected distribution and this polyploidy may well be a result of isolation. No work was carried out to see if the plants in this population are apomitic or inbreeding.

Although chromosome numbers of $n = 6$ and $n = 12$ occur in plants of *H. calycinus*, there appear to be no morphological distinctions between the cytotypes.

TABLE I
Chromosome number of Hybanthus species.

| Species | Locality | n | 2n | Collection Number |
|--------------------------------|-------------------------|----|----|------------------------------|
| Subgenus <i>Ionidium</i> | | | | |
| Section <i>Suffruticosi</i> | | | | |
| <i>H. enneaspermus</i> ... | King River | 8 | | EMS 1731 |
| subsp. <i>enneaspermus</i> ... | Darwin | 8 | | NB 595 |
| | Broome | | 16 | L 6001 |
| <i>H. aurantiacus</i> | Durack River | 8 | | EMS 1822 |
| | Broome | | 16 | EMS 1925 |
| | Walter James Range ... | 8 | | ASG 8887 |
| Section <i>Variabiles</i> | | | | |
| Group I | | | | |
| <i>H. floribundus</i> | Parkerville | 24 | | EMB 2207 (x2), 2801 |
| subsp. <i>floribundus</i> ... | Brookton Highway ... | 12 | 24 | EMS 532 |
| | W. of Merredin | 12 | | EMB 2141 (x3) |
| | S. of Salmon Gums ... | 12 | | EMB 2156 (x3) |
| | *Ravensthorpe | 12 | 24 | EMB 2190 |
| | S. of Pingrup | 12 | | EMB 2199 (x2) |
| | Kalgarin | 12 | | EMB 2201 |
| | E. of Kondinin | 12 | | EMB 2202 (x2) |
| | W. of Kondinin | 12 | | EMB 2203 |
| | E. of Corrigin | 12 | | EMB 2204 |
| | Geraldton | 12 | | EMB 2241 (x5) |
| | Perenjori-Paynes Find | 12 | | EMB 2243 (x4) |
| | Warriedar Station ... | 12 | | EMB 2245 |
| | Dongara | 12 | | EMB 2216 |
| | Kalbarri | 12 | | PGW 6725 |
| | E. of Southern Cross | 6 | 12 | EMB 2151, 2803 |
| <i>H. floribundus</i> | Norseman | 6 | 12 | EMB 2152 (x3) |
| subsp. <i>curvifolius</i> ... | Balladonia | 6 | | PGW 7738 |
| | S. of Coolgardie | | 12 | EMB 2804 (x2) |
| <i>H. floribundus</i> | E. of Ravensthorpe ... | 6 | | EMB 2181 (x2) |
| subsp. <i>adpressus</i> ... | Ravensthorpe | 6 | 12 | EMB 2187 (x5), 2455, 2541 |
| | Ravensthorpe | | 12 | RAS 512 |
| | Hopetoun Road | 6 | | EMB 2195 (x2) |
| | S. of Ravensthorpe ... | 6 | | EMB 2189 |
| <i>H. cymulosus</i> | Mt. Singleton | 6 | | EMB 2246-2249 |
| Group II | | | | |
| <i>H. monopetalus</i> | Culoul Range | 4 | | NSW 99494 |
| | Ocean Beach | 4 | | NSW 112261 |
| <i>H. calycinus</i> | Wyadup | 12 | | EMS 1640 |
| | Busselton | 12 | | EMB 2266 |
| | Cape Naturaliste ... | 12 | 24 | EMB 2269 |
| | S. of Mandurah | 12 | 24 | EMB 2254-2257 |
| | Naval Base | 12 | | ASG 9190 |
| | Manning | 12 | | EMB 2253 (x2) |
| | South Perth | 12 | 24 | OAB |
| | Yallingup | 12 | | EMS 1642, 1645 |
| | Gnangara | 12 | | EMS 538 |
| | Yanchep | 12 | | EMS 510, 551, 523, 525 |
| | Lancelin | 12 | | EMS 1332 |
| | Moore River | 12 | | TEHA 3068 |
| | Hill River | 12 | | TEHA 3069 |
| | Dongara | 12 | | EMB 2214 (x2), 2215 (x2) |
| | Dongara | 12 | 24 | TEHA s.n. |
| | N. of Northampton ... | 6 | | ASG 9182 |
| | NW Coastal Highway | 6 | | EMB 2233 (x4) |
| | N. of Northampton ... | 6 | | EMB 2236 (x4) |

| Species | Locality | n | 2n | Collection |
|----------------------|-------------------|----|----|---------------------|
| Group III | | | | |
| <i>H. volubilis</i> | Osmington | | 8 | EMB 2815 |
| <i>H. epacroides</i> | W. of Merredin | 12 | | EMB 2139 (x3), 2140 |
| | S. of Salmon Gums | 12 | | EMB 2166 |
| <i>H. bilobus</i> | N. of Esperance | 12 | | EMB 2167 (x3) |
| | Salmon Gums | 12 | | EMB 2168 |
| | E. of Esperance | 24 | | PGW 8076 |

Extra-Australian Numbers

| Species | Number | | Country | Researcher | Source of Reference |
|-----------------------------|--------|----|-----------------|----------------------------|----------------------------|
| | n | 2n | | | |
| Subgenus <i>Iouidium</i> | | | | | |
| Section <i>Suffruticosi</i> | | | | | |
| <i>H. parviflorus</i> | 12 | 24 | South America | Heilborn | Darlington and Wyle (1955) |
| <i>H. enneaspermus</i> | | 32 | Tropical Africa | Mangenot, S. & G. Mangenot | Ornduff (1967) |

* Large white-flowered plant growing among n = 6 plants of subsp. *adpressus*.

The count of 2n = 32 for the tropical collection of *Hybanthus enneaspermus* indicates that it is a tetraploid if compared with the Australian forms of the species. A count of 2n = 24 has been obtained for the South American species *Hybanthus parviflorus* (Darlington and Wylie 1955). This agrees with the base number x = 6 obtained for some of the Australian species.

Pollen

The tetrads of *Hybanthus calycinus*, *H. floribundus*, *H. cynulosus*, *H. epacroides*, *H. enneaspermus* subsp. *enneaspermus* and *H. monopetalus* are decussate or tetrahedral. All cells have four developing pollen grains, but many also contain one or two microcytes.

The pollen fertility shows no correlation with chromosome number. *Hybanthus calycinus* and *H. floribundus*, irrespective of whether n = 6, 12 or 24, record fertility of up to 95 per cent, whereas other species record a high sterility.

In *H. calycinus* and *H. floribundus* the pollen of n = 12 plants is significantly larger than the pollen of n = 6 plants, but the n = 24 plants have pollen well within the size range of the n = 12 plants.

Anatomy

The material for anatomical work was fixed in FAA and sectioned with a hand-operated bench microtome. Several samples were also embedded in wax before cutting sections with a rotary microtome. The prepared sections were stained in safranin in 50 per cent alcohol, and in fast green in clove oil. Leaves for examination were cleared using the lactic acid technique.

Crystals

Calcium oxalate crystals occur in the leaves of all the Australian species.

Borodin in Solereder (1908) distinguished eight different cases (type and position) of crystals in the Violaceae. Examples of *Viola* type and *Ionidium* type have been found in the species examined. The northern species *Hybanthus aurantiacus* and *H. enneaspermus* have the *Ionidium* crystal type, consisting of clinorhombic crystals scattered along the veins of the leaves.

All the other Australian species have the *Viola*-type of crystals in which the scattered cells contained clustered crystals of druses. These crystals are scattered in the mesophyll of leaves and in the parenchyma of stem, root and rhizome.

Hairs

Unicellular hairs occur on some plants of most species, mainly as epidermal cells of the leaf and young stem. Multicellular hairs occur on the stem of *H. floribundus* subsp. *adpressus*. The unicellular hairs vary among species mainly in the relation of hair length to cell size.

Leaf Anatomy

The leaves of all species are dorsiventral and have a thin cuticle. The epidermis is one-layered except in *H. enneaspermus* where there are layers over the midvein. The epidermal cells of this species contain mucilage. In all species stomata, mainly of the cruciferous type, occur on both the upper and lower epidermis.

In *H. enneaspermus* and *H. aurantiacus* the rectangular crystals are distributed along the veins. In all the other species the crystals are druses scattered throughout the mesophyll.

Stem

In all the species examined the stem structure is that of a typical dicotyledon. With age the epidermis of the stems develops a bark layer of several rows of periderm cells.

In all the Western Australian species except *H. volubilis* the parenchyma cells of the cortex have scattered included crystals. Phloem fibres are developed in all species. These are not conspicuous in young stems but in the older stems they develop as a band several layers thick. *H. volubilis* in cross section appears to have a triangular stem with a bundle of fibres well developed below the angles which continue as a 1-or 2-celled layer around the remainder of the stele.

In all species the central pith layer consists of parenchyma cells; some of these have included crystals which do not, however, occur in *H. volubilis*. The vessels are spirally thickened and have opposite bordered pits. In *H. epacroides* and *H. bilobus* the pits are simple. The perforation plates are simple and the intervacular pitting is opposite. The fibres are septate with simple pits in *H. epacroides* and *H. bilobus*, and with bordered pits in the other species.

Nectaries

Only the sessile nectaries in the *Hybanthus* species from the South-West Land Divisions were examined. Scattered stomata occur on the nectary surface, particularly towards the base. The outer cells of the nectary are smaller than the remaining secretory cells. Covering the cells is a cuticle. The remainder of the gland consists of numerous secretory cells closely packed together in a dense mass.

Citation of Specimens

In the citation, the districts in Western Australia are those given by Diels (1904). For most species only a few of the herbarium specimens seen have been cited. The abbreviations used for herbaria follow the Index Herbariorum pt.

1 ed. 5 (1964), with the addition of GAUBA for the Department of Botany, the School of General Studies, Australian National University, Canberra, and UWA for the Department of Botany, University of Western Australia.

HYBANTHUS

- Hybanthus* Jacq., Enum. Plant. Carib. 2:17 (1760), nom. cons. Type: *H. havanensis* Jacq.
Calceolaria Loeffl., Iter Hisp. 183 (1758), nom. rej. Type: *C. calceolata* Loeffl.
? *Pombalia* Vand., Fasc. Pl., 7 (1771). Type: *P. ipeacacantha* (L.) Vand. ex L.
Solea Spreng. in Schrader, Journ. Fur die Bot. 2:192 (1802). Type: *S. verticillata* (Orteg.) Spreng.
Ionidium Vent., Jard. Malmaison t. 27 (1803). (nom. illeg., nomenclatural synonym of *Solea* Spreng.). Type: *I. polygalaeifolium* Vent. *I. verticillata* (Orteg.) Roem. et Schult.
? *Cubelium* Raf., Catalog. 13 (1824). Type: *C. concolor* (T. F. Forster) Raf.
Pigea Ging. in DC., Prodr. 1:307 (1824). Type: *P. filiformis* Ging. in DC.
Ionia Pers. ex Steud., Nom. Bot. ed 1, 1:433 (1821) *Ionidium*
Vlamingia De Vr. in Lehmann, Pl. Preiss. 1:398 (1845). Type: *V. australasiaca* De Vr.
? *Acentra* Phil., Sert. Mendoc. alt. 3 (1871). Type: *A serrata* Phil.
Clelandia J. M. Black, Journ. and Proc. Roy. Soc. S. Austral. 56:46 (1932). Type: *C. convallis* J. M. Black
? *Orthion* Standl. et Steyerl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22:249 (1940). Type: *O subsessile* (Standl.) Standl. et Steyerl.

Not all the above generic names have been applied to Australian *Hybanthus* species. However, Australian species have been described or included in *Calceolaria*, *Solea*, *Ionidium*, *Pigea*, *Vlamingia* and *Clelandia*. These six genera I consider to be synonyms of *Hybanthus*, an opinion arrived at from the study of the type species or of their descriptions.

It is impossible for me to draw conclusions about the synonymy of the other genera, particularly as there is disagreement in recent literature. Melchior (1925) included the first eleven genera under *Hybanthus*. Hutchinson (1967) considered *Cubelium* to be a distinct genus, but all the other genera he regarded as synonyms of *Hybanthus*. Airy Shaw (1966) regarded *Clelandia* and *Orthion* as separate genera, but all the other genera, including *Cubelium* he regarded as synonyms of *Hybanthus*.

Perennial herbs, undershrubs or semi-creepers. White pithy bark developed on underground rhizome of perennial herbs and on tap roots of undershrubs. *Stems* branching at base or above, smooth or ribbed from leaf bases and stipules, glabrous to densely pubescent, developing thin or pithy bark with age. *Leaves* alternate or clustered, occasionally opposite, sessile or shortly petiolate, linear to lanceolate, glabrous or with scattered to dense pubescence of simple hairs, sometimes tomentum disappearing with age, flat to conspicuously revolute; margins entire or crenate or dentate; tip acute or obtuse. *Stipules* present or absent, terete or flat and linear to lanceolate, entire or divided, white or grey or green, all tipped with prominent usually deciduous gland. *Inflorescence* axillary, cymose or racemose, or flowers solitary. Peduncle and pedicel approximately equal in length; bracts, coriaceous or hyaline, glabrous to densely pubescent or ciliate along margins, green, or grey or white. Flowers zygomorphic. Sepals 5, free, subequal, linear to ovate, blue to green, margins entire or ciliate, apex recurved or appressed to petals. *Corolla* of 5 free petals, violet to purple, or yellow to orange. Anterior petal distinctly spurred and prominently clawed between lamina and spur; claw with two parallel ridges which extend into both the spur and into the prominently veined lamina. Lateral petals of dissimilar pairs; 2 outer petals linear, prominently 1-3 nerved; 2 inner petals broader, lanceolate, ovate or falcate-oblique, prominently nerved. *Stamens* 5; filaments short; anthers free (but appearing united by apical and lateral connecting tissues), narrow ovate, erect, bilocular, introrse, dehiscing in longitudinal slits, glabrous or penicillate with long white hairs, or with scattered to dense short white pubescence, sometimes bearing orange or white subulate loculi-appendages; nectaries at base of two anterior anthers.

Ovary superior, ovoid-globose, tricarpellate, unilocular, placentation parietal, ovules 3-15; style simple, sigmoid; stigma expanded above, orientated towards front of flower. *Fruit* a thick-walled coriaceous capsule, splitting in three at dehiscence, subtended by persistent perianth. *Seeds* 1-12, globose to oblong, surface reticulate, foveate, ribbed or smooth. Embryo spatulate or linear, endosperm copious, dark brown or yellow.

TABLE 2
Comparative features of the Sections Suffruticosi and Variabiles.

| Section | <i>Suffruticosi</i> | <i>Variabiles</i> |
|----------------------------|---|--|
| Distribution | Northern Australia | Southern Australia |
| Flower colour | blue, yellow, orange | mauve to white |
| Seed colour | yellowish white | dark brown |
| Testa surface | ribbed, foveate or smooth | smooth, foveolate or reticulate |
| Nectaries | <i>H. enneaspermus</i> , elongated, glabrous or penicillate; <i>H. aurantiacus</i> sessile, hirsute | sessile, glabrous |
| Ovules | 12+ | 6 or less |
| Embryo | spatulate | linear |
| Chromosome number | n = 8 | n = 4, 6, 12, 24 |
| Crystal shape distribution | rectangular, along veins | druses, scattered in leaf, mesophyll, root and stem parenchyma |
| Venation | close reticulate | open reticulate |

Infrageneric divisions

Schulze (1936) divided the American species of *Hybanthus* into the two subgenera *Eulybanthus* and *Ionidium*, the former having the filaments and to a lesser extent the anthers connate into a tube whilst in the latter they are free. All the Australian species have free anthers and so are included in the subgenus *Ionidium*.

This subgenus he divided into four sections, three of which are not applicable to the Australian species but the section *Suffruticosi* includes the two northern Australian species *H. enneaspermus* and *H. aurantiacus*. Schulze recognised that a new section was required to provide for the remaining eight Australian species. This section I propose to call *Variabiles* due to the variation in the inflorescence forms found within the group. A comparison of the sections *Suffruticosi* and *Variabiles* is given in Table 2.

The *Variabiles* are characterised by the following features—

- (i) shrubs or perennial herbs.
- (ii) leaves alternate, although one species has opposite leaves in the upper part of the plant.
- (iii) base of anterior petal distinctly gibbous.
- (iv) nectaries at the base of the anterior stamens flat and sessile.
- (v) ovules 6 or less in the ovary.

The section can be further divided into three groups on the form of the inflorescence.

- Group I. Inflorescence dichasial: *H. floribundus* and *H. cymulosus*.
 Group II. Inflorescence a raceme: *H. monopetalus*, *H. debilissimus* and *H. calycinus*.
 Group III. Flowers solitary: *H. vernonii*, *H. volubilis*, *H. epacroides* and *H. bilobus*.

Key to the Australian Hybanthus species

1. Flowers solitary, subtended by one pair of bracts.
 2. Inner lateral petals lanceolate falcate.
 3. Gland at base of anterior anthers elongated, glabrous or tipped with tuft of long hairs
 1. *H. enneaspermus*
 2. *H. aurantiacus*
 3. Gland at base of anterior anthers sessile, usually densely hirsute
 2. Inner lateral petals oblong.
 4. Anterior petal 6 mm long or longer.
 5. Plant twining
 8. *H. volubilis*
 9. *H. vernonii*
 5. Plant a shrublet, never twining
 4. *H. floribundus*
 4. Anterior petal 3-5 mm long.
 6. Plant glabrous or with few scattered hairs
 10. *H. epacroides*
 11. *H. bilobus*
 6. Plant densely hirsute.
 7. Leaves linear: sepals glabrous or sparsely pubescent
 10. *H. epacroides*
 7. Leaves obovate to bilobed; sepals densely hirsute along margins and veins
 11. *H. bilobus*
 1. Flowers not solitary (or if solitary several pairs of sterile bracts present below flower).
 8. Inflorescence racemose.
 9. Inner lateral petals lanceolate-falcate
 5. *H. monopetalus*
 9. Inner lateral petals oblong.
 10. Stipules triangular, prominent. Racemes about 20 cm long
 7. *H. calycinus*
 10. Stipules absent or very small. Racemes 2-3 cm long
 6. *H. debilissimus*
 8. Inflorescence dichasial or branched.
 11. Stipules flat. Anterior petal 9 mm or more long
 3. *H. cymulosus*
 11. Stipules terete. Anterior petal less than 9 mm long
 4. *H. floribundus*

Subgenus **Ionidium** G. K. Schulze, Bot Jb 67: 453 (1936). *Ionidium* Vent., Jard. Malmaison t. 27 (1803). Type: *I. polygalaefolium* Vent. (nom. illeg.) \equiv *I. verticillata* (Orteg.) Roem. et Schult.

Section **Suffruticosi** G. K. Schulze, Bot. Jb. 67: 453 (1936). Schulze described only South American species and as I have not seen any of these species I feel incompetent to choose a lectotype for the section.

1. *Hybanthus enneaspermus* (L.) F. Muell., Fragm. 10:81 (1876).

Viola enneasperma L., Sp. Pl. 2: 937 (1753). Type from Ceylon, Hermann (holo.: BM, photo seen).

For synonymy see Tennant 1962. From a study of the photographs of the types of *Viola suffruticosa* L. and *Viola enneasperma* L., and because of the variability noticeable within the species, I have decided to follow Tennant and to regard them as being conspecific.

Perennial spindly herb or compact shrub to 60 cm tall. Stems glabrous or with \pm scattered hairs. Leaves alternate, subsessile; lamina (5x1) 40x2 (90x5) mm, linear to lanceolate, margins entire to crenate, glabrous or with scattered pubescence; stipules linear to subulate, 1-7 mm long, glabrous, grey-white. Flowers solitary. Sepals lanceolate, 3-4 mm long, acute, \pm prominently carinate, glabrous or with \pm scattered pubescence (especially along keel), green. Anterior petal 8-15 mm long; lamina violet or pale yellow. Lateral petals of dissimilar pairs; 2 outer linear-oblong, 3-4 mm long; 2 inner lanceolate-falcate, 4.5-5.5 mm long. Stamens: filaments dimorphous, 3 posterior short, 2 anterior \pm equal in length to anthers and bearing elongated glabrous nectaries tipped with a dense tuft of hairs; anthers oblong-elliptic, loculi appendages absent. Capsule 4-9 mm long; seeds 5-12, ovoid-ellipsoidal, 2-3 mm long, longitudinally ribbed, \pm pitted between ribs, yellowish-white.

Key to subspecies

1. Stipules long (up to 4 mm). Margins of leaf closely revolute, usually glabrous, but if pubescent then hairs spreading. Flower blue subsp. *enneaspermus*
1. Stipules short (\pm 1 mm). Margins recurved, leaves up to 5 mm wide, hairs always antrorse. Flowers yellow subsp. *stellarioides*

subsp. *enneaspermus*

Pigea banksiana Ging. in DC., Prodr. 1:307 (1824). Type: "in Nova-Cambria austr. *Viola angustifolia* Banks herb. (DC. vs. in h. Banks)." (holo: BM, photo seen).

Ionidium banksianum (Ging. in DC.) Steud., Nomen. Bot. Ed. 2. 1:813 (1840).

Hybanthus enneaspermus var. *communis* f. *angustifolia* Domin, Biblioth. Bot. 89:982 (1928).

Type: Lower Victoria River, F. Mueller, May 1856 (lecto: K, photo seen).

Hybanthus enneaspermus var. *banksianus* (Ging.) Domin, l.c.

Flowers blue. Leaves entire or crenate, margins closely revolute occasionally flat; \pm pubescent with spreading hairs, dark green on upper surface, paler underneath. Stipules up to 4 mm long, scarious, opaque, midvein \pm prominent.

Distribution: This subspecies is found in the north of Western Australia, the Northern Territory, Queensland and Northern New South Wales (Figure 2). In addition it is found in Malaysia, South and East Africa, India and Ceylon. 272 collections were seen from Australia and South Africa.

Western Australia: Gibb River, C. A. Gardner 9991 (PERTH); Kimberley District, 1888, E. Giles (MEL); King River, October 1906, W. V. Fitzgerald (NSW); Karunjie Station, 6 Feb. 1959, J. B. Ritson (CANB).



Figure 2—Distribution of *Hybanthus enneaspermus* (L.) F. Muell. subsp. *enneaspermus*.

Northern Territory: South Bay, Bickerton Island, *R. L. Specht* 519 (AD); 64.7 miles SE Top Spring Store, *G. Chippendale* 5815 (PERTH); Stoward Springs, 5 Apr. 1958, *W. McKay* (BR1); Port Darwin 1883, *Foelsch* (MEL); 14 miles SE Mountain Valley, *D. J. Nelson* 234 (NT).

Queensland: 2 miles E of Normanton Township, 5 Mar. 1954, *M. Lazarides* (NT); Cooktown, 1877, *A. W. Persietz* (MEL); between Cloncurry and Camooweal, June-December 1899, *R. C. Barton* (BR1); Townsville, August 1901, *E. Betteh* (NSW); Bloomfield, *W. L. Jones* 1564 (CANB); vicinity of Nicholson River, 1886, *Dietrich* (AD); Alva Beach, Ayr, *R. Carolin* 4620 (SYD).

New South Wales: New England near Armidale, *Bishop Twiner* (MEL).

subsp. *stellarioides* (Domin) E. M. Bennett stat. nov.

H. enneaspermus var. *stellarioides* Domin, *Biblioth. Bot.* 89:983 (1928). *Type:* In *rupibus collis* apud. opp. Yarraba, alt. cca 550 m s.m. *K. Domin* 6794, January 1910 (holo: PR).

H. enneaspermus var. *communis* f. *flavus* Domin, l.c. *Type:* "Keppel Bay, *R. Brown* Iter Australiense 1802-05 No. 4949 als *Pombalia flava*." (holo: K, photo seen).

H. enneaspermus var. *communis* f. *pubescens* Domin, l.c. *Type:* "Northumberland Islands, *R. Brown* No. 4949 als *Pombalia flava* f. *mollis*." (holo: n.v.).

Flowers yellow. *Leaves* entire or crenate, \pm pubescent on margins, hairs antrorse, dark green on upper surface, paler beneath. *Stipules* short, adpressed against stem, short, scarious, opaque, margins pubescent.

Distribution: This subspecies is found close to the east coast of Queensland and New South Wales (Figure 3). 132 collections were seen.

Queensland: Mt. Cotton, *S. L. Everist* 1019 (BR1); Broadsound and Heads of the Isaacs. *R. Brown* 155 (MEL); Brammo Bay, Dunk Island, July 1917, *E. J. Banfield* (NSW); "The Rocks" Ayr, 13 Mar. 1952, *F. H. Kleinsmidt* (CANB).

New South Wales: Moona River, Walcha, Dec. 1884, *A. R. Crawford* (MEL); Hathead Mt. Korogora Pt., 19 Jan. 1953, *E. F. Constable* (NSW); Kew, Autumn 1917, *J. B. Cleland* (AD); Kendall, Feb. 1950, *T. M. White* (SYD).



Figure 3—Distribution of *Hybanthus enneaspermus* (L.) F. Muell. subsp. *stellarioides* (Domin) stat. nov.

2. *Hybanthus aurantiacus* (F. Muell. ex Benth.) F. Muell., Pl. North West. Austr.: 5 (1881)

Ionidium aurantiacum F. Muell. ex Benth., Fl. Austr. 1:102 (1863). Type: N.W. Coast of Australia, *Bynoe* (syn: K, photo seen); Victoria River (syn: K, photo seen; MEL); Cygnet Bay, N. W. Coast *A. Cunningham* (syn: BM, photo seen).

Hybanthus emneaspermus var. *aurantiacus* (F. Muell. ex Benth.) F. Muell., Pl. Indig. Shark Bay 6 (1883).

Hybanthus miniatus F. Muell. et Tate, Trans. Proc. Roy. Soc. S.A. 13:97 (1890) (nom. nud.). Type: Gills Creek, S.A., (n.v.). See Trans. Proc. Roy. Soc. S. Austral. 19:83 (1894).

Hybanthus elegans Domin, Biblioth. Bot. 89:984 (1928). Type: between Ashburton and Yule Rivers, W.A., *F. Clement* (holo: K, photo seen.).

Compact shrub to 60 cm tall. Stems scabrous or \pm glabrous. Leaves alternate or clustered at the nodes, subsessile (4x1) 35x4 (65x5) mm, linear to lanceolate, coriaceous, margin serrate-dentate occasionally entire, densely hirsute or occasionally glabrous; stipules linear to subulate, 1-30 mm long, pubescent or occasionally glabrous, green and leaf-like or yellow-white and pithy. Flowers solitary. Sepals lanceolate, 3-6 mm long, acute \pm prominently carinate or 3-nerved, ciliate, otherwise glabrous, green. Anterior petal 7-15 mm long; lamina yellow to orange. Lateral petals of dissimilar pairs: 2 outer, linear-oblong, 3-5 mm long; 2 inner, lanceolate-falcate, 3.5-6.5 mm long. Stamens; filaments dimorphous: 3 posterior short, 2 anterior \pm equal in length to anthers and bearing sessile glabrous to densely pubescent nectaries; anthers oblong-elliptic, loculi appendages absent. Capsule 5-9 mm long; seeds 5-10, ovoid-ellipsoidal, 2-3 mm long, smooth, pitted, or longitudinally ribbed, yellowish white.



Figure 4—Distribution of *Hybanthus aurantiacus* (F. Muell. ex Benth.) F. Muell.

Distribution: This species is found in the north of Western Australia, Northern Territory, Queensland, and far north of South Australia (Figure 4). 221 collections were seen.

Western Australia: Cape Range, *A. S. George* 2508 (PERTH); Fortescue River, June 1878, *J. Forrest* (MEL.); Lennard River, May 1906, *W. V. Fitzgerald* (NSW); Corong Creek, S. of Port Hedland, *N. T. Burbidge* 5838 (CAMB); Pass of the Abencerrages, *P. G. Wilson* 2437 (AD).

Northern Territory: 50 miles N. of Tennant Creek township, *R. A. Perry* 608 (BR1); Alice Springs, *J. R. Maconochie* 471 (PERTH); Ormiston Gorge, *G. M. Chippendale* 2116 (NT); Mt. Liebig, 23 Jul. 1966, *J. H. Willis* (MEL); 1 mile N.W. Lasseters Cave, Peterman Range, 11 Mar. 1959, *D. J. Nelson* (NSW); 9.5 miles NNW Alice Springs township, 5 May 1955, *M. Lazarides* (CANB); New Rabuntja, 1932-33, *Strehtlow* (AD); Alice Springs, *Gauba* (CBG); Emily Gap, 7 Jul. 1966, *R. C. Caroliu* (SYD).

Queensland: Lake Corella, Mary Kathleen, *H. J. Lavery* 110 (BR1); Georgina River, Sept. 1910, *E. W. Bick* (BR1); Clonlurry, Flinders River, 1876, *A. Henry* (MEL); Currawilla, *S. L. Everist* 3941 (CANB); Moongerrie, 16 Jan. 1928, *R. D. Riddell* (AD).

South Australia: Cooper Creek, *E.N.S. Jackson* 428 (AD).

Section *Variabiles* E. M. Bennett sect. nov.

Flores lilacini vel albi. Glandulae in antheris anticis sessiles, glabrae. Ovarium ovulis usque ad 6; embryo linearis.

Type: *Hybanthus calycinus* (DC. ex Ging.) F. Muell.

Flowers mauve to white. Nectaries on anterior anthers sessile, glabrous. Ovules 6 or less per ovary; embryo linear. Seeds dark-brown, surface smooth, foveate, or reticulate. Calcium oxalate druses scattered in leaf mesophyll, and in root and stem parenchyma.

Group 1: Inflorescence dichasial.

3. *Hybanthus cymulosus* C. A. Gardn., Journ. Roy. Soc. W. Austral. 22: 125 (1936).

Type: Austin district, at the Northern base of Mt. Singleton, W.A., *W. E. Blackall* and *C. A. Gardner*, 9 July 1931 (holo: PERTH).

Perennial herb to 70 cm tall. Leaves alternate, sessile, narrow-lanceolate to linear, 20-50 x 1-3 mm; stipules 0.1-0.5 mm long, tripartite to lacinate, occasionally entire. Inflorescence 3- to many-flowered in axillary dichasia, 2-5 cm long. Sepals lanceolate 4-6 mm long, tip slightly recurved, ciliate on margin, mid nerve prominent, blue to green. Anterior petal 8-15 mm long, sparsely ciliate on edge, pale violet. Lateral petals of dissimilar pairs, 2-4 mm long, pale violet; 2 outer oblong, 1-nerved, 2 inner orbicular, 3-nerved. Stamens shorter than lateral petals, no loculi appendages present. Capsule 5 mm long, seeds 1-3, ovoid-ellipsoidal, ca 3 mm long, dark-brown, prominently pusticulate.

Distribution: Austin District of Western Australia near the townsite of Paynes Find (Figure 8). 8 collections were seen.

Western Australia: Ninghan, between homestead and Great Northern Highway, *A. S. George* 3713 (PERTH); 220 miles Paynes Find Road, *C. A. Gardner* 10209 (PERTH); Northern slopes of Mt. Singleton, *E. M. Strymgeour* 2112 (PERTH); 7 miles from Great Northern Highway to Mt. Singleton, *E. M. Bennett* 2246, 2247 (PERTH).

4. *Hybanthus floribundus* (Lindl.) F. Muell., Fragm. 10: 81 (1876).

Pigea floribunda Lindl. in Mitch., Three Exped. 2:164 (1838) n.v., ed. 2, 2:165 (1839). *Type:* Mitchell's Journey, 1836, July 6 No. 223 (iso: MEL).

Iouidium floribundum (Lindl.) Walp., Repert. Bot. Syst. 2:767 (1843).

Calceolaria floribunda (Lindl.) O. Kuntze, Rev. Gen. Pl. 1:41 (1891).

Iouidium australasiae Behr, Linnaea 20:629 (1847). *Type:* Süd Australien Lyndock Valley in der Barossa range und in dem Pine Forest-Walde, *H. Behr*. (holo: HAL).

Ionidium multiflorum Turcz., Bull. Soc. Nat. Mosc. 27, Sect. 2:340 (1854). Type: Nova Hollandia. Drummond 5th Coll. No. 72 (holo: n.v.)
Ionidium breviflabre Benth., Fl. Austr. 1:102 (1863). Type: West. Austr. Drummond 665 (syn: MEL); Swan River, Drummond, 1st Coll. (syn: n.v.).
Clelandia convallis J. M. Black, Trans. and Proc. Roy. Soc. S. Austral. 56:47 (1932). Type: Wilpena Pound, S.A., J. B. Cleland (holo: AD).

Shrub to 1.5 m tall. Leaves alternate, sessile, linear, lanceolate or oblong, 5.35 x 0.5-7 mm, acute or obtuse \pm recurved; stipules linear 0.5-1.5 mm long, glabrous or with a few trichomes towards base. Inflorescence axillary, dichasial or racemose to 40 mm, occasionally flowers solitary. Sepals 0.75 to 4 mm long, pale blue to white or dark blue to green; 2 inner petaloid, \pm 1 mm longer than 3 outer. Anterior petal 4-11 mm long, pale blue to white. Lateral petals of dissimilar pairs: 2 outer petals oblong, 1.5-3 mm long, 1-nerved, 2 inner petals broadly oblong, 2.5-4 mm long, 3 or more nerved. Anther surfaces glabrous or with scattered white hairs, loculi appendages sometimes present. Capsule to 8 mm long; seeds 1-4, ovoid-ellipsoidal, 2-3 mm long, reticulate, foveate, or smooth, dark brown.

Key to subspecies

1. Sepals petaloid, pale blue, apices recurved. Leaves \pm appressed upwards against stem.
 2. Leaves narrow, conduplicate (Ravensthorpe area) subsp. *adpressus*
 2. Leaves broad, flat, distinct pustules on surface subsp. *floribundus*
1. Sepals dark blue to green, apices appressed to petals. Leaves variously spreading.
 3. Leaves conduplicate, curved (Norseman area) subsp. *curvifolius*
 3. Leaves flat, not curved subsp. *floribundus*

subsp. *floribundus*

Leaves \pm flat, apex \pm unciniate.

Distribution: This subspecies is found in the south of Western Australia, South Australia, Victoria and southern New South Wales (Figure 5). 319 collections were seen.

Western Australia: 12 km SW Queen Victoria Spring, D. W. Goodall 2964 (PERTH); Victoria Desert Camp, R. Helms 58 (MEL); Cundeelee Mission, March 1963, M. C. George (NSW); East Yuna, A. C. Burns 97 (PERTH); ca. 20 miles east of Merredin, R. Carolin 3089 (SYD.); Yilgarn, Herb. F. Mueller (AD); Wedgicarrup W. of Wagin, N. T. Burbidge 2359 (CANB); Bannister, 31 Jul. 1950, J. McNeur (CANB); W.A., Sept 1930, E. Ashby (ADW); Waroona, July 1907, G. F. Barthoud (NSW).

South Australia: Port Lincoln, 1874, I. L. Browne 5 (MEL); Eyre Peninsula, 28 Aug. 1958, Gauba (GAUBA); Old Coach Road 3-4 miles W. of Stony Pinch, D. E. Symon 3819 (CANB); Wilpena Pound, July 1937, A. E. V. Richardson (ADW); near Chain of Ponds, Torrens Gorge 24 Aug. 1946, J. Vickery (NSW); Mt. Remarkable, 17 Sept. 1958, H. M. Cooper (AD); Mt. Lofty Range, J. G. V. Syme (BRI).

Victoria: Between Ouyen and Hopetoun, 6 Jul. 1966, C. W. E. Moore (CANB); Stawell, Apr. 1911, J. Staer (NSW); 12 miles S. of Ouyen, 8 Sept. 1961, M. E. Phillips (CBG); Warracknabeal, 10 May 1903, F. M. Reader (MEL); Bendigo, August (BRI).

New South Wales: Near Barellan, August 1927, G. V. Scammell (SYD, CANB); near Ardlethan, 8 Aug. 1966, L. D. Pryor (GAUBA); Nericon near Griffith, G. R. Sainly 257 (NSW).

Queensland: Queensland, Mather (BRI). This locality is doubtful.

Included under subsp. *floribundus* are plants which at their extremes appear to be subspecifically distinct but which are in fact connected by intermediate variants.

There is a large form at Queen Victoria Spring in Western Australia which reaches a much greater height (up to 1.5 m) than the common shrubby plants of this species. Two characters were found useful in recognising herbarium specimens of this plant, firstly the flower size and secondly the glaucous and pustular appearance of the leaf surface. However plants occurring in South Australia, particularly those growing around Wilpena Pound, have flowers which are within the lower size limits of the Queen Victoria Spring plants. Also some South Australian plants have a leaf texture and surface similar to that found in the plants collected in Western Australia, South Australia and Victoria.

Plants with oval glaucous leaves occur in various localities throughout Australia but there are several collections showing intermediates between the typical and glaucous ones. One of the glaucous plants collected near Southern Cross has a different chromosome number ($n=6$) from the typical subsp. *floribundus* ($n=12$).

From herbarium specimens alone it is difficult to distinguish these several different forms; further collecting and possibly cytological work will need to be carried out before any definite conclusion on their taxonomic status can be reached.

subsp. **adpressus** E. M. Bennett subsp. nov.

Folia ad caulem sursum \pm adpressa, angusta, conduplicata. *Sepala* petaloidea apicibus recurvis.

Leaves \pm appressed upwards against stem, narrow, conduplicate. *Sepals* petaloid, apices recurved.

Type: 5 miles south of Ravensthorpe, in heavy brown clay, W.A., 16 May, 1968. E. M. Bennett 2195 (holo: PERTH).

Distribution: This subspecies is found in the Eyre district of Western Australia near Ravensthorpe (Figure 5). 29 collections were seen.

Western Australia: South-west coast and interior of Western Australia, G. Maxwell (MEL); 1.5 miles along old road north of Ravensthorpe, F. Lullfitz 5252 (PERTH); 34 miles E. of Ravensthorpe E. M. Bennett 2189 (PERTH).

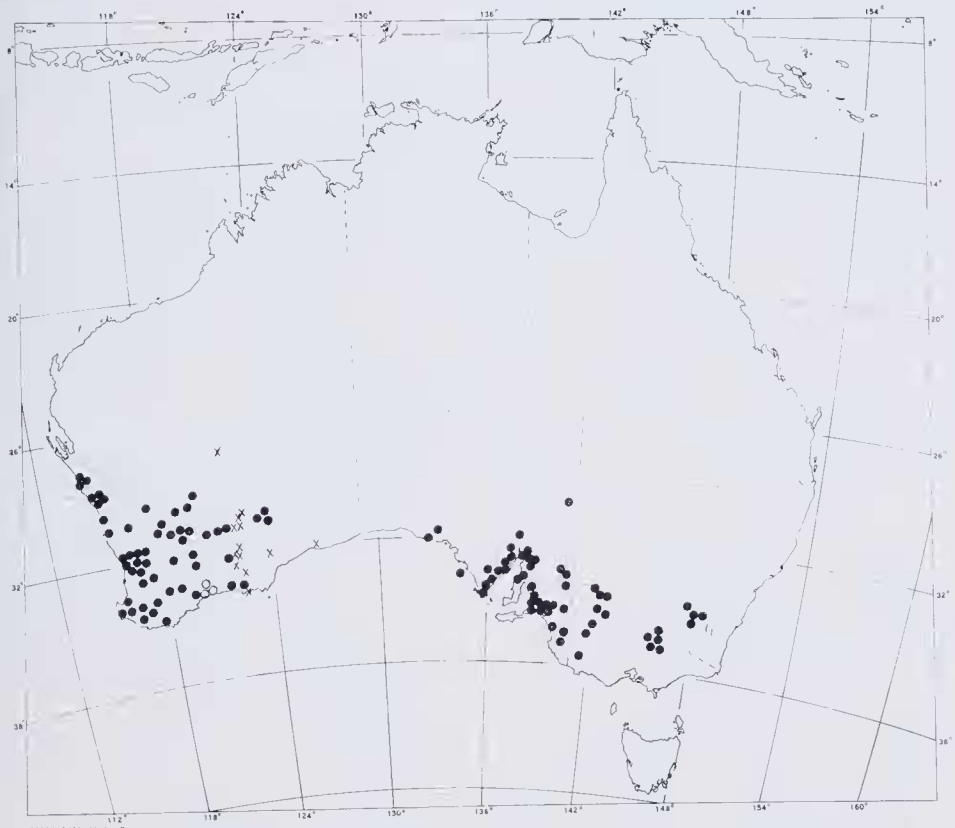


Figure 5—Distribution of *Hybanthus floribundus* (Lindl.) F. Muell. subsp. *floribundus* (●), subsp. *adpressus* E. M. Bennett (○) and subsp. *curvifolius* E. M. Bennett (x).

subsp. *curvifolius* E. M. Bennett subsp. nov.

Folia conduplicata, manifeste curvata, apicibus uncinatis.

Type: South edge of Lake Cowan, Norseman district, W.A., 15 May 1968. *E. M. Bennett* 2152. (holo: PERTH).

Leaves conduplicate, distinctly curved, apex uncinata.

Distribution: This subspecies is found in the Coolgardie district of Western Australia between and east of the townsites of Kalgoorlie and Norseman (Figure 5). 43 collections were seen.

Western Australia: Comet Vale, Aug. 1917, *J. L. Jutson* (MEL); Coolgardie, July 1899, *R. Helms* (NSW); Mt. Thirsty, Norseman, *J. Barnes* 6079 (PERTH); Between the bank and Eyres Relief, *Maxwell* (MEL); 13 miles SE of Coolgardie on Coolgardie Esperance Highway, *B. G. Briggs* 278 (NSW); Londonderry, *K. Newbey* 2588 (PERTH).

Group II: Inflorescence a raceme

5. *Hybanthus monopetalus* (Roem. et Schult.) Domin, Biblioth. Botanica 89: 984 (1928).

Ionidium monopetalum Roem. et Schult., Syst. Veg. 5:400 (1819). *Type*: "Ex anglia habuit Römer in Herbario suo." (holo: probably once at LZ, if so now destroyed; ?iso: BM).

Pigea monopetala (Roem. et Schult.) DC. ex Ging. in DC., Prodr. 1:307 (1824).

Solea monopetala (Roem. et Schult.) Spreng., Syst. Veg. 1:804 (1825).

Calceolaria monopetala (Roem. et Schult.) Britten in Banks and Solander, Illustrations of the Botany of Captain Cook's Voyage 1:7 (1900).

Hybanthus monopetalus var. *normalis* Domin, Biblioth. Bot. 89:985 (1928) nom. illeg.

Hybanthus monopetalus var. *abbreviatus* Domin, l.c. *Type*: Sandsteinhügel der Blue Mts. nicht selten (Domin IV. 1910); Blue Mts., *C. T. White*; Port Jackson (Georges Head), *R. Brown* 1805; *R. Brown* Iter Australiense 1802-05 No. 4951; Blue Mts., *A. Cunningham*. (syn. n.v.).

Pigea filiformis DC. ex Ging. in DC. Prodr. 1:307 (1824). *Type*: Port Jackson (holo: G-DC, photo seen).

Ionidium filiforme (DC. ex Ging.) F. Muell., Pl. Indig. Col. Vict. 1:66 (1862).

Hybanthus filiformis (DC. ex Ging.) F. Muell., Fragm. 10:81 (1876).

Calceolaria filiformis (DC. ex Ging.) O. Ktze., Rev. Gen. Pl. 1:41 (1891).

Ionidium linearioides Presl, Bot. Bemerk. 12 (1845). *Type*: "Habitat in Nova Hollandia ad Port Jackson, collegit Sieber." (holo: PR, n.v.).

Hybanthus tatei F. Muell. ex Tate. Fl. Extratrop. S.A. 19 (1890). *Type*: Wilpena, S.A., (holo: MEL).

Calceolaria tatei (F. Muell. ex Tate) O. Ktze., Rev. Gen. Pl. 1:41 (1890).

Perennial herbs to 60 cm tall. *Leaves* alternate (upper leaves \pm opposite), linear to oblong, 5-90x0.5-4 mm; stipules linear-lanceolate to triangular-deltoid, 0.25-1.5 mm long. *Inflorescence* axillary racemose, to 20 cm long. *Anterior petal* 5-21 mm long, blue. *Lateral petals* of dissimilar pairs, mauve, 2 outer lanceolate acute, 2 inner broadly lanceolate-falcate, oblique, rounded edge raised with several enlarged cells. *Anthers*: loculi appendages (if present) narrow triangular, <0.5 mm, white or orange. *Capsule* 6 mm long; seeds 3-6, reticulate to reticulate-foveolate, black.

Distribution: This species is found in South Australia, S.E. Victoria, New South Wales and eastern Queensland (Figure 6). 265 collections were seen.

Queensland: Wallangarra, *W. T. Jones* 2617 (CANB); Mt. Barney slopes, Macpherson Ranges, 15 Nov. 1952, *E. F. Constable* (NSW); Bribie Island and Pine River, *Eaves* (MEL); Callabah, *S. L. Everist* 3116 (BRI).

New South Wales: Clarence River, 1869, *Wilroy* (MEL); near Tinda Creek, Putty Road, 20 Feb. 1961, *M. E. Phillips* (CBG); in bushland near Bundanoon, 29 Nov. 1961, *Gauba* (GAUBA) Khyber Pass, east of Rylstone, *H. S. McKee* 936 (SYD); Wollomombi, 17 Dec., 1950, *G. L. Davis* (AD); 2 miles W. of Karuah, 12 Oct., 1953, *L. A. S. Johnson* (NSW); Blackheath Nov. 1914, *A. A. Hamilton* (NSW).

Victoria: Avon and Mitchell River, Dec. 1884, *F. Mueller* (MEL); Nitta Nitta, Oct. 1919, *S. F. Cliton* (MEL).

South Australia: Wundinna, 7 Apr. 1936, *E. H. Ising* (AD); Summit of Mt. Woodroffe, Musgrave Ranges, *D. E. Symon* 2663 (ADW).

Under *Ionidium monopetalum* Roemer and Schultes gave a short diagnosis and cited *Viola monopetala* as a manuscript name. The authors gave the origin of the type specimen as "Ex Anglia habuit Römer in Herbario suo." The bulk of the specimens on which Roemer and Schultes descriptions were based were housed at LZ and are now destroyed.

The name "*Viola monopetala*" which was cited in synonymy by Roemer and Schultes was used by Robert Brown both in his unpublished manuscript and in his herbarium for the same species as that described by Roemer and Schultes. It is possible that it was through Brown that Roemer and Schultes obtained the type. This means that the collection of Robert Brown's housed at the British Museum (Natural History) is a possible isotype. A photograph of a plant collected at Port Jackson, on May 11, 1802 by Robert Brown has been seen.

6. *Hybanthus debilissimus* F. Muell., Fragm. 11:4 (1878).

In silvis Karri-forests secus flumen Shannon, (W.A.), F. Mueller. (holo: MEL; iso: AD). *Calceolaria debilissima* (F. Muell.) O. Kuntze Rev. Gen. Pl. 1:41 (1891).

Perennial herb, procumbent or low-growing. Leaves alternate, sessile or shortly petiolate, lanceolate, 5-25x2-5 mm, stipules not present (minute?). Inflorescence of 1-3 flowers in axillary racemes, 2-3 cm long. Sepals narrow-lanceolate, 2-4 mm long, acuminate, glabrous, deep-blue edged with white. Anterior petal 5-12 mm long, blue. Lateral petals of dissimilar pairs, 2-3 mm long, mauve, 2 outer petals narrow oblong, 1-2 nerved; 2 inner petals broadly

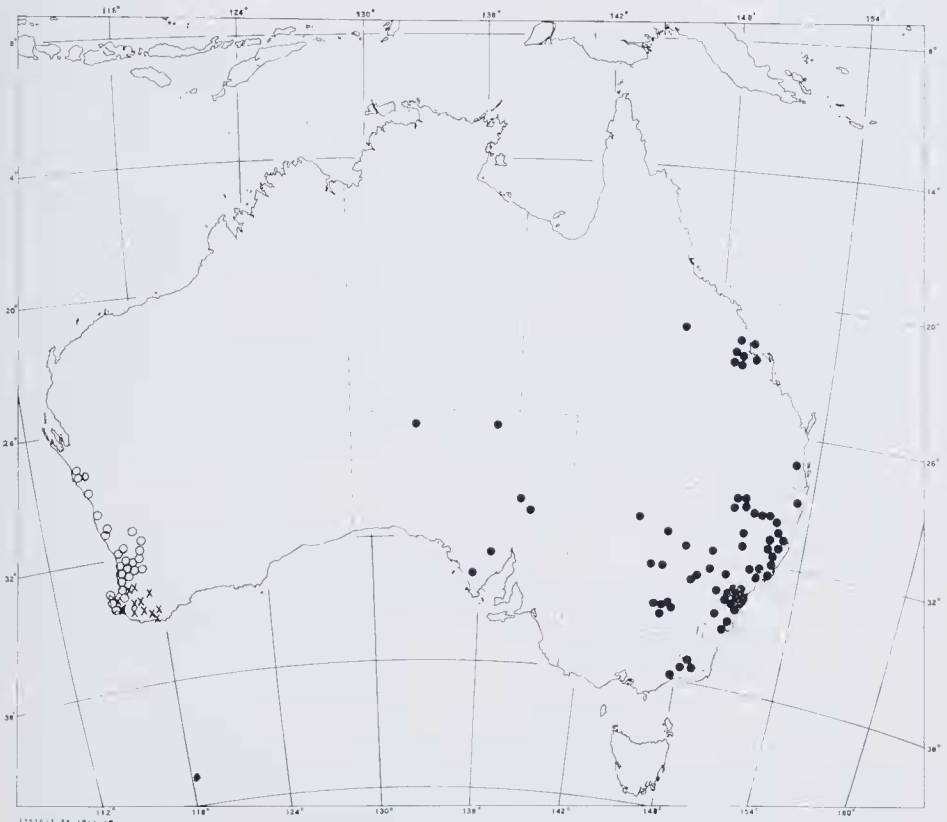


Figure 6—Distribution of *Hybanthus monopetalus* (Roem. et Schult.) Domin (●), *H. debilissimus* F. Muell. (x) and *H. calycinus* (DC. ex Ging.) F. Muell. (○).

oblong, 3-4 nerved. *Stamens*: paired loculi appendages (when present) narrow-triangular, <0.5 mm long, white or orange. *Capsule* 5 mm long; seeds ca. 6, dark brown, pustulate.

Distribution: This species is found in the Warren and Darling districts of Western Australia (Figure 6). 26 collections were seen.

Western Australia: Stream banks on outskirts of Collie, A. R. Fairall 760 (PERTH); near Pemberton, 18 Oct. 1919, C. G. Sargent (NSW); near Mt. Lindsay, 1879, Muir (MEL); Hamden, Clarke (MEL); Margaret River, R. D. Royce 4683 (PERTH).

Mueller, in his original description, stated that there are small stipules present at the base of the leaves, but none of the herbarium specimens (including the type) shows these.

7. *Hybanthus calycinus* (DC. ex Ging.) F. Muell., *Fragm.* 10:81 (1876).

Pigea calycina DC. ex Ging. in DC., *Prodr.* 1:307 (1824). *Type*: Nouv. Holland: Côte occidentale (holo: P, photo seen).

Pigea glauca Endl. in Endl. et al., *Enum. Pl. Huegel* 5 (1837). *Type*: Freemantle ad Swan-River, Hügel (holo: W).

Solea calycina (DC. ex Ging.) Spreng., *Syst. Veg.* 1:804 (1825).

Vlamingia anstraliaciaca De Vr. in Lehmann, *Pl. Preiss.* 1:399 (1845). *Type*: Herb. Preiss, No. 1449 (holo: W).

Ionidium glaucum (Endl.) F. Muell., *Pl. Col. Vict.* 1:67 (1862).

Ionidium calycinum (DC. ex Ging.) F. Muell., *Pl. Col. Vict.* 1:224 (1862).

Calceolaria calycina (DC. ex Ging.) O. Ktze., *Rev. Gen. Pl.* 1:41 (1891).

Perennial herb to 60 cm tall. *Leaves* alternate, sessile, linear, 2-4.5x 0.1-0.3 cm, glabrous or scabrous; stipules linear-lanceolate, 0.2-1.0 mm long, glabrous ± pubescent. *Inflorescence* a 5- to many-flowered axillary raceme, ca. 20 cm long. *Sepals* lanceolate, 3-7 mm long, prominently 3-5 nerved, glabrous or with ciliate margins, blue with white margins. *Anterior petal* 10-16 mm long, blue to purple. *Lateral petals* of dissimilar pairs, 3.5-4.5 mm long, margins recurved, ciliate, blue to purple, prominent purple veining. *Stamens* densely pilose, purple; paired loculi appendages narrow-triangular, <0.5 mm long, orange. *Capsule* 6 mm long; seeds 3-6, ovoid to ellipsoidal, 2-5 mm long, black, prominently reticulate.

Distribution: This species is found in the coastal regions of the Irwin, Darling, and Warren districts of Western Australia (Figure 6). 123 collections were seen.

Western Australia: 45 miles NE. Perth, F. W. Went 65 (PERTH); Moorsby Range, Howatharra, A. C. Burns 3 (PERTH); 43 miles N. of Geraldton A. S. George 9182 (PERTH); Cape Naturaliste, E. M. Bennett 2269 (PERTH); Ogilvie, N. T. Burbidge 2142 (CANB); Leederville, 1 Aug. 1897, R. Helms (BR1); King's Park Perth, Dec. 1910, J. Sheath (NSW); Between Champion Bay and Port Gregory, Oct. 1877, F. Mueller (MEL); 18 miles N. of Bunbury, 21 Oct. 1962, M. E. Phillips (CBG).

Group III: Flowers solitary

8. *Hybanthus volubilis* E. M. Bennett sp. nov. (Figure 7).

Herba perennis volubilis. *Folia* alterna, sessilia, vel linearia vel lanceolata, herbacea; stipulae lineares. *Flores* axillares, solitarii, violacei. *Sepala* lineari-lanceolata, acuta, recurvata. *Petalum* anticum manifeste calcaratum, album venis atrovioleaceis, petala lateralia oblonga. *Loculi antherarum* appendicibus anguste-triangularibus. *Ovarium* ovoideum vel globosum, glabrum, ovulis 6.

Twining perennial herb. *Leaves* alternate, sessile, linear-lanceolate, 10-18x2.4 mm, occasionally basal leaves 16-20x5.6 mm chartaceous, glabrous; stipules linear, glabrous, 0.25 mm long. *Flowers* axillary, solitary. *Sepals* lanceolate to linear, acute, 2.2-5 mm long, recurved, green to purple. *Anterior petal* 6-8 mm long, lamina white with mauve veining. *Lateral petals* oblong, apices truncate, recurved, 1.5-2.5 mm long, blue-mauve with darker veining.

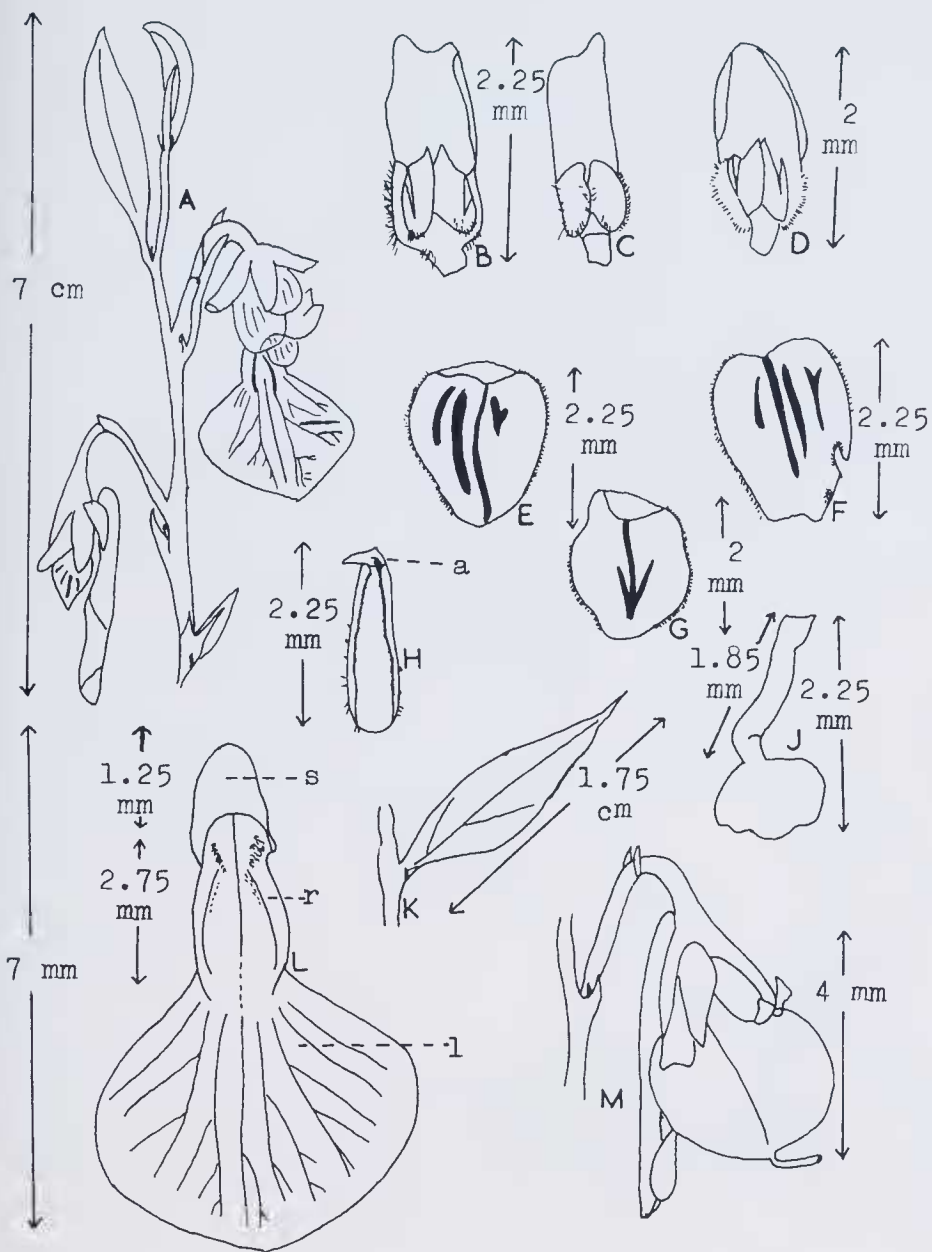


Figure 7—*Hybanthus volubilis* sp. nov. A—Inflorescence. B—Posterior surface of anterior anther. C—Anterior surface of anterior anther. D—Posterior anther. E—Posterior surface of inner petal. F—Anterior surface of inner petal. G—Outer petal. H—Sepal, J—Ovary. K—Leaf. L—Anterior petal. M—Capsule. a = apex recurred; s = spur; r = raised ridges; l = anterior petal, white with mauve markings.

Anthers green-yellow; loculi appendages narrow-triangular, 0.25-0.5 mm long, orange-yellow. *Ovary* ovoid to globose, glabrous, ovules 6. *Capsule* 5 mm long; seeds 1-6 per capsule, ovoid-ellipsoidal, ca. 2.5 mm long, smooth, mottled pale and dark brown.

Type: 8 miles E. of Margaret River townsite on banks of Margaret River, W.A., 17 Nov. 1968, E. M. Bennett 2815 (holo: PERTH).

Distribution: This species is found in the Warren district of Western Australia near the townsite of Margaret River (Figure 8).

Western Australia: Rosa Brook, R. D. Royce 2803 (PERTH); on banks of Margaret River, Osmington, R. D. Royce 2464 (PERTH); Osmington, Margaret River district, R. D. Royce 4621 (PERTH).

9. *Hybanthus vernonii* (F. Muell.) F. Muell., *Fragm.* 10:81 (1876).

Ionidium vernonii F. Muell., *Pl. Indig. Col. Vict.* 1:223 (1862). *Type*: Twofold Bay, N.S.W., F. Mueller (syn: MEL, K, photo); Genoa River, Vic., Sept. 1860, F. Mueller (syn.: BM, photo seen).

Calceolaria vernonii (F. Muell.) O. Kuntze, *Rev. Gen. Pl.* 1:41 (1891).

Hybanthus euneaspermus (L.) F. Muell. var *vernonii* (F. Muell.) Domin, *Biblioth. Bot.* 89:982 (1928).

Perennial herb or shrub to 90 cm tall. *Leaves* alternate, sessile, basal leaves usually lanceolate, upper leaves linear 5-45x1-4 mm, stipules ca. 0.5 mm long, linear. *Flowers* solitary in axils of upper leaves. *Sepals* lanceolate, 1.5 to 5 mm long, glabrous or outer surface scabrous, green to dark blue, margins

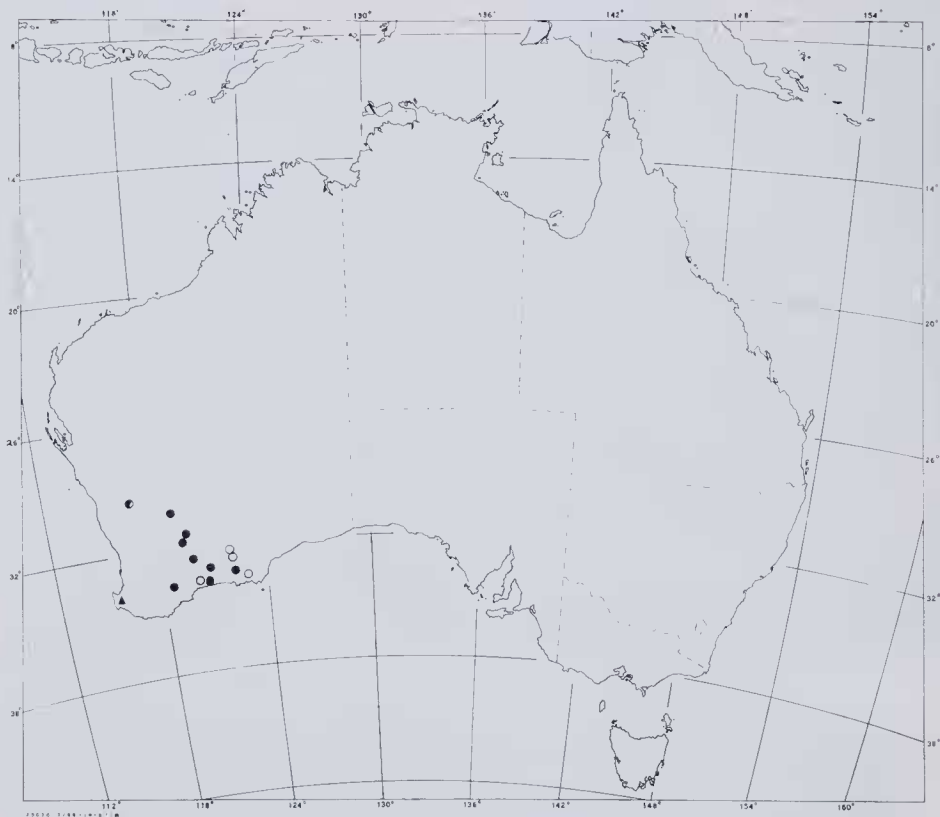


Figure 8—Distribution of *Hybanthus cymulosus* C. A. Gardn. (◉), *H. volubilis* sp. nov. (▲), *H. epacroides* (C. A. Gardn.) Melch. (●) and *H. bilobus* C. A. Gardn. (○).

± white. *Anterior petal* 6-13 mm long, blue to mauve. *Lateral petals* of dissimilar pairs, 1.5-3 mm long, blue to mauve. 2 outer petals narrow-oblong. 1-nerved, 2 inner petals broadly oblong, several nerved. *Stamens*: anterior anthers densely pubescent on surface, posterior 3 ± shortly pubescent; loculi appendages white, narrow-triangular, <0.5 mm long. *Capsule* 6-8 mm long; seeds 3-6, ovoid-ellipsoidal, ca. 2.5 mm long, brown, smooth to lineolate.

Key to subspecies

Leaves and stems glabrous. Upper leaves linear, lower usually lanceolate subsp. *vernonii*
 Leaves and stems scabrous. Leaves lanceolate, oblanceolate or tricuspidate subsp. *scaber*

subsp. *vernonii*

Leaves and stems glabrous. Lower leaves much broader than upper leaves, linear to lanceolate, 5-45x1-4 mm.

Distribution: This subspecies is found along the Central and South coast of of southern New South Wales and Eastern Victoria (Figure 9).

57 collections were seen.

New South Wales: Kiola State Forest, South Coast, 26 Oct. 1966, *M. Evans* (CANB); Jervis Bay, 28 Sept. 1961, *Gauba* (GAUBA); National Park N.E. Sector, 16 Aug. 1927, *O. D. Evans* (SYD); Middle Harbour Sydney, Sept. 1909, *J. B. Cleland* (AD); Green Cape Track, 8 Oct. 1961, *M. E. Phillips* (CBG); Port Jackson, *W. Vernon* (MEL); Gynea, *R. H. Goode* 456 (NSW). *Victoria* Gippsland, Point Ricardo, *L. B. Muir* 3783 (MEL); near mouth of Snowy River, *E. Pescott* 14 (MEL).



Figure 9—Distribution of *Hybanthus vernonii* (F. Muell.) F. Muell. subsp. *vernonii* (●) and subsp. *scaber* (○).

subsp. *scaber* E. M. Bennett subsp. nov.

Caules costis scabris. *Folia* 5-15x1.5-2.5 mm, vel lanceolata vel oblanceolata vel tricuspidata, pilis in paginis ambabus sparsis, praesertim abundioribus in venis et in marginibus recurvis.

Stems scabrous along ribs. *Leaves* 5-15x1.5-2.5 mm varying from lanceolate to oblanceolate to tricuspidate, with scattered hairs on both surfaces, especially abundant along veins and recurved margins.

Type: Stockout Creek, Coledale Road, N.S.W., Oct. 1909, J. L. Boorman (holo: NSW 97630).

Distribution: This species is found along the east coast of New South Wales (Figure 9). 14 collections were seen.

New South Wales: Track to Green Cape, 8 Oct. 1961, M. E. Phillips (CBG); Bundanoon, 21 Apr. 1934, L. R. F. and J. W. V. (SYD); Clyde district, Dec. 1884, W. Baeuerlen (MEL); Stockyard Gully near Copmanhurst, 23 Jul. 1967, K. Grieve (NSW); near Turpentine Nowra-Braidwood, 15 Jul. 1934, F. A. Rodway (NSW).

10. *Hybanthus epacroides* (C. A. Gardn.) Melch., Nat. Pflanzenfam. Ed. 2:21:360 (1925).

Ionidium epacroides C. A. Gardn., J. and Proc. Roy. Soc. W. Austral. 9:35 (1923). *Type*: near Mt. Marshall, half a mile south of Bencubbin Station, 2 June 1922, C. A. Gardner 1696 (holo: PERTH; iso: MEL).

Shrub to 40 cm high, spinescent, lateral branches divaricate. *Leaves* clustered at nodes, sometimes alternate, linear to spatulate, 2-7 x 0.5-1.0 mm, apex recurved; stipules linear to lanceolate, \pm 0.5 mm long, glabrous except for few hairs towards base. *Flowers* axillary or arising from middle of leaf cluster, solitary. *Sepals* ovate-lanceolate, ca. 1.5 mm long, glabrous or ciliate, pale blue to white. *Anterior petal* 3-5 mm long, pale blue. *Lateral petals* of dissimilar pairs, oblong 1.5-3 mm long, apices truncate, recurved, pale blue to white, veining purple. *Anthers* purple, \pm pubescent; loculi appendages absent. *Capsule* 5 mm long; seeds 1-2, ovoid-ellipsoidal, ca. 3 mm long, smooth, mottled pale and dark brown.

Distribution: This species is found in the Coolgardie and Eyre districts of Western Australia (Figure 8). 22 collections were seen.

Western Australia: Lake Cronin, Forrestania, 13 June 1929, C. A. Gardner (PERTH); 146 miles Great Eastern Highway, E. M. Scrymgeour 689 (PERTH); Nangeenan, F. Stoward 3 (NSW); 2 miles West of Norseman, 17 September 1962, M. E. Phillips (GBG).

11. *Hybanthus bilobus* C. A. Gardn., J. Roy. Soc. W. Austral. 19:86 (1933).

Type: Hamersley River, near Eyre Range, 23 Sept. 1925, C. A. Gardner 1886 (holo: PERTH). *H. floribundus* (Lindl.) F. Muell, var. *minutifolia* F. Muell, Fragm. 10:82 (1876). *Type*: Crescit a Phillips River usque Cape Arid, Maxwell (holo; MEL).

Shrub to 20 cm tall, lateral branches divergent forming a dense intricate network. *Leaves* scattered, usually crowded in small clusters at the nodes, sessile, obdeltoid, 1-2x0.5-1.5 mm, truncate, appearing bilobed as a result of the recurved central portion of the apex; stipules linear, \pm 0.5 mm long, densely hairy in lower half. *Flowers* axillary or arising from middle of leaf cluster, solitary. *Sepals* lanceolate to oblanceolate, 1.5-2.5 mm long, densely hirsute along margins and veins. *Anterior petal* 3-4 mm long, pale blue. *Lateral petals* of dissimilar pairs, oblong, 2-3 mm long, pale blue, veining purple. *Anthers* blue or green, pubescent, loculi appendages not present.

Distribution: This species is found in the Eyre and Coolgardie Districts of Western Australia (Figure 8). 10 collections were seen.

Western Australia: Mungilginup River, \pm 50 miles east of Esperance, 8 Sept. 1963, J. H. Willis (MEL); 544 mile peg Norseman-Esperance road, E. M. Bennett 2168 (PERTH); 5 miles S of Salmon Gums, 10 Aug. 1951, N. H. Brittan (UWA).

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